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Fw: Syracuse Univ. scientist guest blogs on Myers ' groundwater paper
Stephen Kraemer to: GJMoridis 05/15/2012 04:43 PM

FYI

----- Forwarded by Stephen Kraemer/ATH/USEPA/US on 05/15/2012 04:39 PM -----

From:	Jeanne Briskin/DC/USEPA/US
To:	"Susan Burden" <Burden.Susan@epamail.epa.gov>, "Dr. Stephen Kraemer" <Kraemer.Stephen@epamail.epa.gov>, "Nathan Wiser" <Wiser.Nathan@epamail.epa.gov>, "Charles Hillenbrand" <Hillenbrand.Charles@epamail.epa.gov>, "Jill Dean" <Dean.Jill@epamail.epa.gov>
Date:	05/15/2012 12:21 PM
Subject:	Fw: Syracuse Univ. scientist guest blogs on Myers' groundwater paper

Fyi.
Sent by blackberry

From: [bart.seitz@bakerbotts.com]
Sent: 05/15/2012 04:18 PM GMT
To: Jeanne Briskin
Subject: Syracuse Univ. scientist guest blogs on Myers' groundwater paper

Hello, Jeanne,

I'm sure you've heard by now about Dr. Tom Myers' recent paper published in the National Ground Water Association journal. Since I assume that EPA will be considering that paper's thesis as part of your study on hydraulic fracturing, I thought you might find interesting the following response to Dr. Myers' paper.

Feel free to contact me if you have any questions. Thank you.

Bart

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From: energyindepth@energyindepth.org [mailto:energyindepth@energyindepth.org]
Sent: Tuesday, May 15, 2012 11:15 AM
Subject: ICYMI: Syracuse Univ. scientist guest blogs on Myers' groundwater paper

http://www.energyindepth.org/siegel-groundwater/

Errors in Myers' Groundwater Paper from Start to Finish


Donald I. Siegel, Ph.D.

Professor of Earth Sciences, Hydrogeologist; Syracuse Univ.
EID Guest Blogger -- May 13, 2012

Last month, the journal of the National Ground Water Association published a paper <
http://www.energyindepth.org/wp-content/uploads/2012/05/myers-potential-pathways-from-hydraulic-fracturing4.pdf >
by an environmental consultant in Nevada in which the proposition is put forth that the vertical transport of contaminants from the Marcellus formation of southern New York to potable, near-surface aquifers is not only plausible, but likely – brought to us in as few as "three years," he argues, and all because of hydraulic fracturing.

It's an explosive thesis, to be sure – but one that's also fatally flawed; very good news for those of us who actually live here in upstate New York. Predictably, and perhaps as designed, the paper generated a great deal of attention in the press after ProPublica first reported <
http://www.propublica.org/article/new-study-predicts-frack-fluids-can-migrate-to-aquifers-within-years> its conclusions on May 1. But as I attempt to explain below, the physical realities governing the hydrodynamic flow of fluids underground can't be as Dr. Tom Myers <
http://water.nv.gov/hearings/past/springetal/browseabledocs/exhibits%5CCTGR%20Exhibits/CTGR_EXH_006%20Statement%20of%20Qualifications%20of%20Tom%20Myers,%20Ph.D..PDF>, the report's author, suggests. I say this as someone who has studied the specific hydrogeology of New York for more than 30 years.

I found a number of fundamental errors in Myers's model upon initial, cursory review. Some of the most obvious:

Problem 1: Mistaken assumptions on rocks above the Marcellus Shale.

Among the most significant errors made by Myers was his assuming that most of the deep rocks overlying the Marcellus Shale do not consist of dry, dense shale. As explained in E&E News <
http://www.eenews.net/energywire/2012/05/04/7> (subs. req'd) earlier this month by my colleague Terry Engelder, it's just not true: most of the rock above the Marcellus consists of shale. And since shale can't pass much water, particularly if it is dry and solid, Myers' computer model cannot calculate proper water flow conditions.

As Engelder explained, instead of being predominantly sandstone, as in Myers' model, the overburden contains 90 percent shale and only 10 percent sandstone. If the sandstone were replaced by shale within Myers' model, the time frame required for water movement to shallow aquifers thousands of feet above the Marcellus would increase to 100,000 years, similar in time to what I found two decades ago when I did my own computer model of deep groundwater flow in southwestern N.Y. and northwestern Pa.

Because the shale is dense, dry, non-porous rock, companies need to fracture it to begin with; otherwise, there would be no way to get the gas out. Myers also fails to recognize that the brine produced from the Marcellus comes from immediately overlying brine-filled aquifers (also a mile or more deep) into which some of the induced fractures penetrate. This fact is clear from micro-seismicity studies and even more so from the ratios of dissolved elements such as chloride and bromide in the produced fluids. But, there is no local communication of these dense salty water to the surface, because of thick intervening dense and dry rock.

Problem #2: Mistaken assumptions with respect to movement of groundwater.

It appears Myers does not understand some basic concepts and science behind groundwater movement through sedimentary basins. Water in the Marcellus under the Appalachian Plateau (southern New York and northern Pennsylvania) does not naturally move upward by means of artesian pressure toward the land surface, as Myers assumes. And because of only this error, his model fails on first principles.

For more than 60 years, hydrogeologists (if not engineers) have understood that groundwater moves in nested flow systems; regional, intermediate, and local in size. The Appalachian Plateau topographically constitutes the regional replenishment area for long flow paths of deep brines all the way to Lake Ontario, but only along a few focused and rare deep fault systems. It takes hundreds of thousands of years for water to make this journey, if not much longer. The shallow groundwater system from which people get their drinking water on the Appalachian Plateau occurs within the upper 1000 feet (usually far shallower), ubiquitously separated by thousands of feet of dense dry rock, mostly shale, from the deep basin salt waters at the depth of the Marcellus. *This understanding of groundwater moving in sedimentary basins has been so well established that every modern hydrogeology textbook produced over the past five decades contains it.*

I know of no instance of deep groundwater on the Appalachian Plateau moving upward under artesian pressure toward the land surface, except in glacial cut valleys that penetrate through this thickness. Period. And I've see a lot of water level measurement on the Plateau over the years, both in New York and in Pennsylvania.

Problem #3: Assumed fracture-lengths wildly exaggerated.

Myers suggests that faults or fissures opened by hydraulic fracturing can and will move dense formation water (flowback and produced waters) upward for one to two miles into shallow, potable waters. It's an assertion that's not grounded in either science or experience.

Indeed, there are fractures at shallow depths (generally no deeper than 600 feet) that produce modest groundwater volumes for individual homes and farms. But these fractures pinch off at depths greater than a few thousand feet. If they did not, natural gas in the Marcellus Shale would have escaped naturally long before now. Because the shale compacts under the weight of all the overlying rocks, oil and gas firms need to use sand to prop fractures open to create the conduits necessary for the hydrocarbon to flow to the wellbore. Despite this basic fact, Myers appears to be arguing that new fractures in the Marcellus can be opened naturally by the very low energies created from hydraulic fracturing, and then stay open through a mile or more of rock that largely consists of shale, even without the introduction of proppant to keep them open. **The suggestion is absurd.**

Myers also fails to recognize that dense produced waters cannot move upward easily into fresh water because they are, well, dense. For decades, hydrologists using MODFLOW (the model Myers used) have incorporated a mathematical correction called "effective freshwater head" in their modeling when large salinity differences occur. Myers assumes the brines in the Marcellus have all the same density as the dilute freshwater at the top. This makes no sense for what he was trying to test. Indeed, it is extraordinarily implausible (bordering on impossible) to imagine brines moving locally upward into fresh water aquifers owing to the density differences. In contrast, it is easy to move brines downward into fresh water because they weigh more than the fresh water.

Conclusion

More than anything else, the public needs to know that a mathematical model of groundwater flow, such as the one prepared by Myers, constitutes only a representation of reality—it is not reality itself. Before any math model can be built, a scientifically plausible conceptual model needs to be developed.

As it relates to this particular paper, Myers has developed an implausible model that predictably leads to implausible, and in my judgment, completely wrong results — from simple first principles of geologic and hydrologic understanding, let alone acceptable model development.

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